PHOTOGRAPHY SIMPLIFIED:

A Practical Treatise

ON THE

COLLODION AND ALBUMEN PROCESSES.

BY

LUDOVICO WOOLFGANG HART,

SAPPER, ROYAL ENGINEERS.

Illustrated with numerous Engravings.

SOUTHAMPTON:

MARSHALL AND CO., 154, HIGH STREET;

SIMPKIN, MARSHALL, AND CO., LONDON;

AND MAY BE HAD OF THE AUTHOR,
ORDNANCE MAP OFFICE, SOUTHAMPTON.

[Entered at Stationers' Hall.]

SOUTHAMPTON:
PRINTED BY MARSHALL AND CO.,
154, HIGH STREET.

PREFACE.

EVERY one who possesses specimens of this beautiful art must, I feel sure, be more or less interested in their production. I have, therefore, endeavoured, in the following pages, to give a lucid description of the art, omitting all technical terms where their place can be supplied by the adoption of more familiar language.

This Work is principally intended for the practice of amateurs, and such persons as have little or no knowledge of chemistry. I have, therefore, of necessity, omitted a great deal of matter which would only confuse the student,

and make this pleasing art appear difficult. For the same reason I have confined myself to the Collodion and Albumen processes, considering that it is far preferable for my readers to learn one good process at a time, and so master the art step by step, instead of acquiring an imperfect knowledge of several processes, with constant failures and discouraging reverses, and all for the want of a more perfect system.

The Writer wishes to call particular attention to the Rules given in this book, page 51, without which the art cannot properly be mastered. Cleanliness is the foundation stone, without which all other practice will be useless. The operator has, therefore, only to learn these few rules, and he will find that the drudgery and toil of the other arts are not to be found here, but that, by following out these simple directions, together with interest and perseverance, all his efforts will be crowned with success by the application of this wonderful art to almost all branches of science.

In conclusion, I must express my thanks to Mr. Jennings, Pharmaceutical Chemist, to whom I am much indebted for assisting me in the revision of my Appendix.

That these few pages may be found not only useful but interesting is the sincere wish of the Author,

LUDOVICO WOOLFGANG HART.

ERRATA.

—

Page 25, Iodide of Potassium, for 1 grain read 4 grains.

CONTENTS.

INTRODUCTION.

BEFORE entering into the practical details of any art it is of great importance that the student should know something of its origin and progress, in order that he may perceive the great changes that, from time to time, take place. Not that I intend to give a lengthened discourse or essay upon the art, for the limits of this work would not allow it. It is my intention, therefore, only to give a few of the principal changes that have taken place more especially during the present century.

The first record of importance that we have on hand is that concerning the Camera Obscura, which appears to have been known as early as the fifteenth century. It was invented by Giovanni Battista Della Porta, a Neapolitan, who possessed an inventive genius; but, unfortunately, the age in which he lived was one of superstition, and his invention, with many others, was strictly prohibited by the Ecclesiastical Court.

The word "Photography" is derived from the Greek, *phos*, which signifies "light," and *grapho*, "I write." Here, then, was its first step.

Years passed by, and nothing important occurred until about the year 1770, when Scheele, a great chemist, a native of Sweden, studied the action of coloured rays of light, with the aid of chloride of silver, on paper; and shortly afterwards Sénebier, the philosopher of Geneva, pursued a similar train

of investigation on the Solar Spectrum by the same means. Other experiments took place about the year 1804 by Dr. Ritter, of Jena, on the nitrate of silver.

About the same time Mr. Wedgewood, in conjunction with Sir Humphry Davy, commenced a series of experiments upon the chlorate, nitrate, and muriate of silver on paper and white leather, and read a paper in the Royal Institution "On copying paintings on glass, and of making profiles by the agency of light," which was published in one of the early Journals about the year 1816. Their great failure was this—after having produced the picture they had no means of preserving it. Davy says, "All that is now required to make these experiments as useful as they are interesting is to find a way to prevent their subsequent colouring of the white parts on exposure to white light."

It was not until 1819 that the hyposulphite

of soda and its properties were discovered by Sir J. Herschell. The next person of importance is Niepce, who named his discovery Heliography, and described his researches "on the method of fixing the image of objects by the agency of light." In 1824 Daguerre, without knowledge of his contemporary, experimented on scientific substances unsuccessfully. Shortly after he was introduced to Niepce, and in 1829 they entered into an agreement for combined research. Niepce died four years after, and in 1839 Daguerre, in conjunction with the son of Niepce, announced his discovery at Paris, and published it.

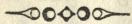
Six months prior to this Mr. Fox Talbot communicated his discovery to the scientific world by reading a paper before the Royal Society (January 31st, 1839) called, "Some account of the Art of Photogenic Drawing, or the process by which natural objects may

be made to delineate themselves without the aid of the artist's pencil." In the following July Daguerre published his works, when the French government granted him a pension of 6000 francs, and 4000 to the son of Niepce. In 1851 Mr. Scott Archer introduced a process for taking portraits on glass, differing but slightly from the present positive process.

Little now remains to be said. Photography has made rapid strides in all parts of the civilised world, and is still continuing to do so. We have only, then, to proceed carefully, following in the steps of our various societies, and reading up all that the renowned names of Hardwich, Hunt, Schnauss, &c., can pen, and Photography will rank eventually as A 1 in the fine arts.

L. W. H.

PHOTOGRAPHY SIMPLIFIED.



THE DARK ROOM.

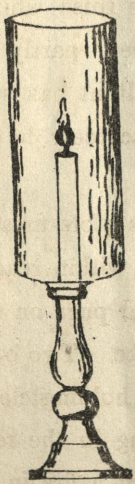
THE first thing necessary for the production of photographs is to procure a dark room, so that no rays of light are admitted underneath the door or any other place. If the room has a window it must be blocked up, leaving a space about eighteen inches square, which must have three folds of yellow calico tacked over it, in order to keep out effectually the rays of white light, allowing at the same time the light to pass through the yellow

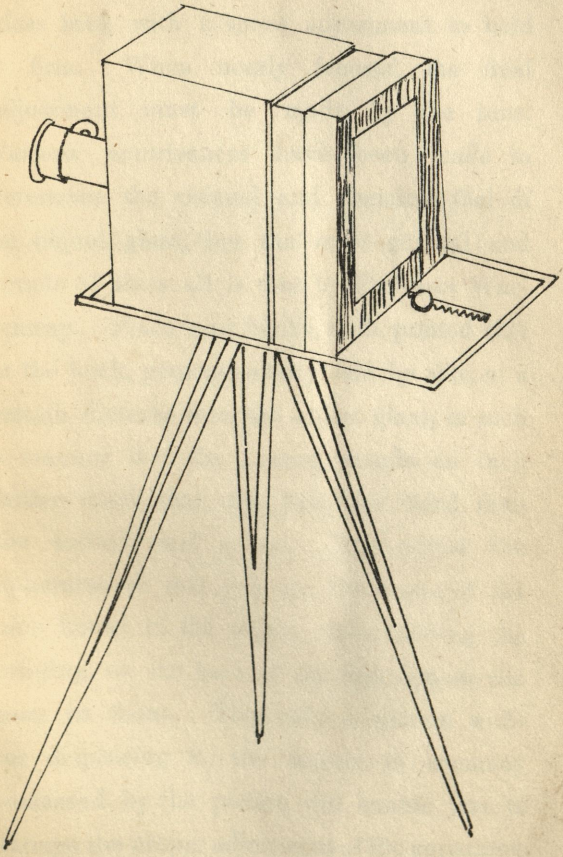
calico, which will not affect or hinder the work. If the room has not a window, a candle with a yellow shade will answer the same purpose. (See Plate I.)

The reason is this: white light affects the nitrate of silver, partly decomposing it; whereas yellow light has so little effect upon it that it can scarcely be said to have any at all.

The operator's table must be directly under the window, and within reach he should have some shelves and pegs on which to place his bottles, towels, &c. Two buckets are also required; one for holding clean water, and another for throwing in the refuse of solutions, &c. If necessary, a fire in the room will not hurt the operation, provided it be not too hot. A temperature of 60° Fahrenheit is good.

The camera is an instrument consisting of two portions (See Plate II.), the one sliding into the other. The back part has an aper-





ture to slide the dark frame or focusing glass into, with a screw adjustment to hold it firm. When nearly focused the final adjustment must be made by the lens. Various contrivances have been made to determine the visional and chemical foci of an object glass, but the most general and simple of them all is that by Professor Warrentrap. Place nine books, with printed title at the back, perpendicularly side by side, at a certain distance from the object glass, in such a manner that the second stands an inch further back than the first, the third than the second, and so on. Now adjust the apparatus so that you see the backs of the nine books in the object glass, making the printing on the back of the fifth appear the most in focus. Then take a picture without displacing it; the amount of accuracy possessed by the picture will enable you to manage the proper adjustment of the apparatus.

The following things are necessary for the manipulation of the process in full, viz. :—

Materials.

Glass plates to fit the different dark slides.

Gutta-percha baths to hold the nitrate of silver solution.

Glass dipper to convey the plates into the nitrate of silver bath.

One large earthenware bowl in which to make the soluble cotton.

One porcelain dish over which the developing is performed.

Levelling tripod stand.

Scales and weights.

Glass measures, large and small.

Glass rods and funnels.

Mortar and pestle.

Thermometer.

Spirit level.

Chemicals.

Cotton wool.

Collodion.

Iodizing solution.

Iodide of potassium.

Iodide of ammonium.

Nitrate of silver.

Glacial acetic acid.

Alcohol.

Ether.

Pyrogallic acid.

Hyposulphite of soda.

Nitric acid.

Sulphuric acid.

Protonitrate of iron.

Protosulphate of iron.

Gallic acid.

Chloroform varnish.

Black varnish.

Tripoli powder.
Solution of ammonia.
Nitrate of potash.
Chloride of gold.
Cyanide of potassium.

The foregoing list of chemicals includes everything required in the process. Most amateurs, however, prefer to purchase their solutions prepared.

To those who are desirous of commencing this most enticing and interesting art, and whose means are limited, I would strongly recommend them to Mr. G. Fleming, 498, Oxford Street, London, who supplies a complete set of apparatus and chemicals for £3 3s.

PREPARATION OF COLLODION

FOR THE POSITIVE PROCESS.

THE preparation of collodion includes four things, viz., the soluble cotton, alcohol, ether, and the iodizing compounds. The soluble cotton or pyroxyline may be prepared either from cotton wool or Swedish paper. For the preparation of the former take 8 ozs. of crystallised nitrate of potash, and powder it; after which place it in a mortar or wide-mouthed bottle, add to it 6 drachms of distilled water, then pour on it 10 ozs. of sulphuric acid, s.g. 1·840, stir up the whole, to make sure of its thoroughly mixing. Take now a quarter of an ounce of cotton wool,

placing it piece by piece in the solution, taking care that it is well saturated, which is done by moving it about with a glass rod. Now put the mortar in a basin of hot water, heated to about 120° to 130° Fahr., in order to keep up the heat of the mixture. Let it remain twelve minutes in this way, then take the glass rod, and with it bring out the cotton wool, and plunge it into a pailful of cold water, stirring it briskly, and changing the water until all traces of the acid have left it; then wring well in a cloth, and, after tearing it to pieces, place it to dry in a current of air, or by a slow fire; the former is preferable.

The soluble cotton or pyroxyline being now dry, we proceed to dissolve it in the following manner. Mix—

5 drachms	of ether	s. g. ·720
3 do.	of alcohol	s. g. ·825

To each ounce of this solution add from three to five grains of soluble cotton. No exact

amount of cotton can be given on account of the various solubilities of different samples. A stock of this uniodized collodion may be kept in a cool place for seven or eight months. If the ether is in large excess the collodion film, when on the glass, will be tough, and when pulled up at one corner will readily peel off the plate without breaking. When in this state its power of contractility is so great that it will retract and separate itself from the sides of the plate. If, however, a little alcohol is added these properties will vanish, the transparent film becoming soft, and easily rubbed off the glass. In the summer season, when the ether quickly evaporates, it is a great benefit to the collodion to add a little alcohol.

To iodize the collodion, make a solution of iodide of ammonium in alcohol, s. g. ·830, adding 32 grs. of the former to 1 oz. of the latter; place them in a stopper-bottle, and

shake up until a solution is obtained, then filter through bibulous paper, and keep in a stopper-bottle. To use this solution the following proportions must be attended to:—Add 1 fluid drachm of iodizing solution to 6 fluid drachms of plain collodion. This must be kept twelve hours before being used. Iodized collodion, when pure and first mixed, is colourless, after which it becomes a lemon tint, then orange, and lastly red. This is due to the free iodine being liberated, caused by the ether gradually reacting upon the alkaline iodide. The preparation of collodion is now complete, and we come to the more direct manipulation.

Having fixed up a background, which ought to be either a dark brown or grey, focus your object, which must be done with great care, so as to avoid any misty appearance. Next clean the glass. I will here mention that this is one of the first essentials

of the art. The following ingredients form the best solution for this purpose. Mix—

Tripoli powder	½ oz.
Strong solution of ammonia .	1 oz.
Alcohol	1 oz.
Distilled water	3 ozs.

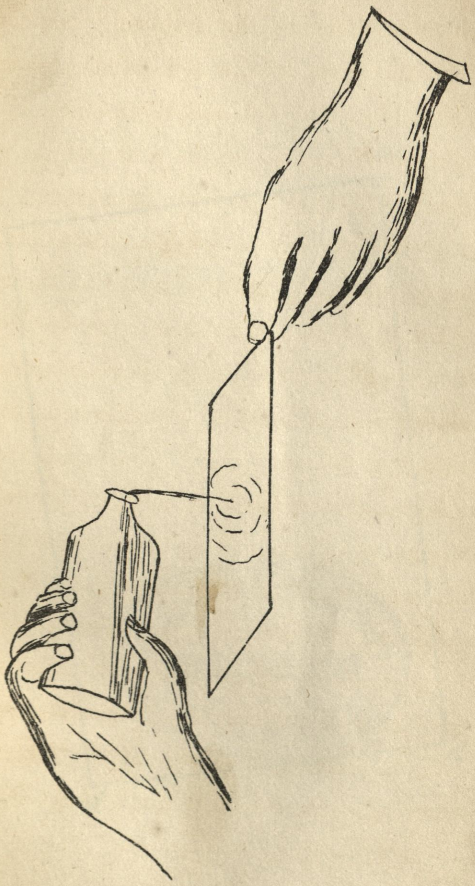
Shake these well together in a stoppered bottle, and drop a little on the glass; then, with a piece of cotton wool made up into a ball, rub the plate until, by constant friction, the solution has become dry and rubbed off.

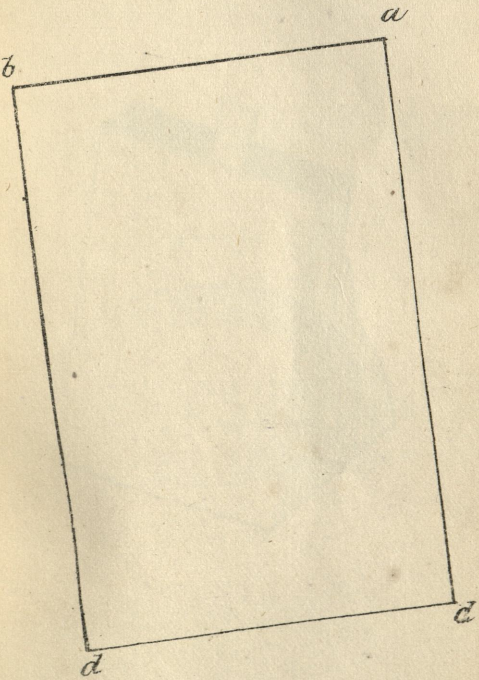
It must now be placed on the pneumatic holder (See Plate III.), and rubbed gently with a piece of old silk, for the purpose of removing the small particles of cotton and dust, taking great care that neither the sleeve nor any other part of the dress of the operator comes in contact with it. In order to know when it is perfectly clean, breathe upon the surface, and if the breath disappears evenly and quickly, without leaving any marks, you can then proceed to collodion your plate,

which is done in the following manner:— Take the plate in the left hand, still upon the holder, and the collodion bottle in the right, pour the fluid on the centre of the plate (See Plate IV.), let it run to the corner A, then to B, crossing over to C, taking particular care not to allow any part to run over the edge of the plate, and pour off into the bottle at D (See Plate IVA.) inclining the plate backward and forward a little to avoid streaks in the collodion.

When the weather is mild, allow twelve seconds to elapse before removing the plate into the bath. If the temperature is high put it in immediately, which is done by placing the plate on the glass dipper, collodion side uppermost, and plunging it steadily into the bath of nitrate of silver (See Plate V.), made according to the following proportions. Mix—

Nitrate of silver	25 grs.
Distilled water	1 oz.

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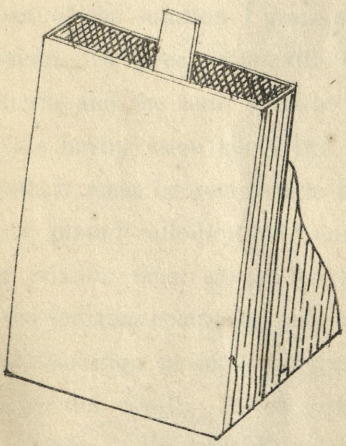


Make this solution slightly acid by adding glacial acetic acid drop by drop until, when the test paper is dipped into it, it becomes red; the bath is then to be saturated with iodide of silver, which is done by adding to every 4 ozs. of the solution 1 grain of iodide of potassium. A precipitate will then be thrown down, and the bath must be filtered.

The plate having been about two minutes in the bath, it must be removed to the dark frame, and placed collodion side downward. A proper relation must always be kept up between the iodizing compound and the bath; if the latter solution be too weak a very pale film will be the result. It has now to be exposed. There is no rule by which I may enable my readers to know the length of exposure, but, from experience with the collodion mentioned in the commencement of my pamphlet, from three to five seconds on a bright day will produce a very good portrait.

We have now arrived at that part of the process called the development, for which there are various solutions; that, however, mentioned by Mr. Hardwich, in his valuable treatise on "Photographic Chemistry," I find superior to any other. The proportions are as follows. Mix—

Protosulphate of iron . . .	12 to 20 grs.
Glacial acetic acid	20 minims.
Alcohol	10 do.
Distilled water	1 oz.

After mixing this, filter it through bibulous paper, and pour some into a little trough or dish, tilting it on one end, in order that the solution may run to that end; then put the plate in at the other, collodion side uppermost. This being done, let the solution run freely over the glass, when the image will almost immediately appear.

My readers must not expect to see the shadows and half tones with the portrait at this stage of the work, as they are concealed

by the unaltered iodide of silver, but will be seen clearly after the fixing, which, after the plate has been well washed, must be done in the following manner. Mix—

Cyanide of potassium	8 grs.
Distilled water	1 oz.

Filter this and pour it over the glass. As soon as the picture is quite free from the white and misty appearance it must be again well washed; if not sufficiently, this solution will completely destroy the picture.

Put it now in some secure place to dry, with the collodion side towards the wall, and a slip of blotting-paper at the bottom to drain off the water. When dry it must be varnished with chloroform or white varnish. Being now finished, it may be put into a frame or case, with a piece of black cloth or black varnish at the back.

I will now make a few remarks as regards the appearance of positives after being finished.

If the picture looks dark, with a gloom upon the features, and the dark parts of the drapery are unseen, the portrait is under-exposed. If, on the contrary, it is too pale and white about the features, it is over-exposed. Much, however, depends upon the sitter, and the manner in which the light falls upon him. Mr. Hardwich observes, "that if the light is shaded from the upper part of the figure the face will be the last to be seen. The operator should, therefore, accustom himself to expend much pains in the preliminary focusing on the ground glass, and to ascertain at that time that every part of the figure is alike illuminated. For this reason portraits taken in a room are seldom successful, the light falling entirely on one side, and hence the shadows are dark and indistinct." This brings to a close the positive process on glass.

THE NEGATIVE PROCESS.

THERE is much to be observed in this process, which differs greatly from that of the positive, the latter having a tendency to be over-developed, whilst the former is very often stopped at too early a period; thus we frequently find the negatives too pale to print well. I shall now describe the process given by Mr. Hardwich for making collodion for negatives.*

Purified ether . . .	s. g.	·720, 5 drachms.
Alcohol	s. g.	·825, 3 do.
Soluble cotton		3 to 6 grains.
Iodide of ammonium . . .		3 to 4 do.

* See Hardwich on Photographic Chemistry, page 177.

Or—

Rectified ether . . .	s. g. ·750,	6 drachms.
Alcohol	s. g. ·836,	2 do.
Soluble cotton		3 to 5 grains.
Iodide of potassium . . .		3 to 4 do.

In making collodion, this writer observes, that he has succeeded best with pyroxyline made from paper; it seems, from some unknown cause, to give more intensity than cotton. If the solution is too fluid, with three or four grains of soluble paper to the ounce, add a grain or so of a glutinous sample made from cotton. In this way, by combining the two, collodion may be made which will yield excellent half tones, and any amount of intensity. If the collodion is glutinous, and produces a wavy surface with less than 4 grains of cotton to the ounce, try Mr. Hardwich's *formula* of adding 10 drops of chloroform to each ounce of the fluid. Being principally engaged in the negative process, and having

tried several specimens of negative collodion, I find that prepared by Mr. Thomas, generally known as the xylo-iodide of silver, outrivals any other for durability after iodizing, independently of its rare qualities in producing some of the most dense negatives I have ever seen.

In using this collodion it is also necessary to use the bath which is prepared expressly for it. Into a 20-oz. bottle put the following items:—

Nitrate of silver	1 oz.
Distilled water	2 ozs.

Then dissolve in a separate glass—

Iodide of potassium	1 grain.
Distilled water	1 drachm.

Mix these two solutions; the precipitate thus formed is, by shaking, entirely dissolved. Now add 14 ozs. of distilled water, when the excess of silver is again thrown down, but in such a manner as to render the saturation of

the bath with iodide of silver complete. After half an hour add—

Alcohol	2 drachms.
Sulphuric ether	1 do.

Filter, and it is ready for use. This bath I find suitable for any negative collodion.

I will now describe the bath requisite for the collodion in Mr. Hardwich's *formula*.

Distilled water	4 ozs.
Nitrate of silver	120 grs.
Acetic acid	1 minim.

Filter this, and keep it in a dark place; it is then fit for use. The plate being now coated must be kept out of the bath from ten to twenty seconds, according to the temperature; then, as before, place the glass upon the dipper, and, by one steady plunge, lower it into the bath, where it must remain from five to eight minutes. Draw it up and down before taking it out of the bath, for the purpose of taking off the greasy appearance it has, caused by

the ether and water coming in contact; allow it to drain, but not too closely, and place it in the dark frame. I have before observed that there is no rule by which you may know the length of exposure; but if you allow it just twice the time for a negative as you did for a positive you will, after a few trials, be enabled to hit upon the exact time.

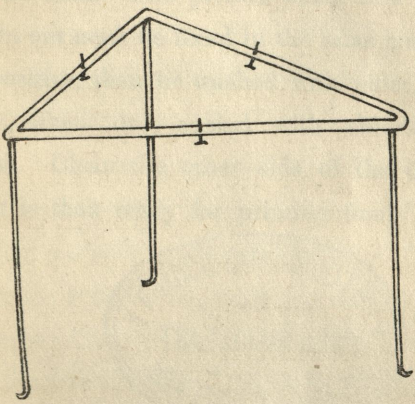
The plate having been a sufficient time in the camera, you proceed to develope it. I have tried a great many developing agents, and find that the following proportions have produced me the best results, viz.:—

Pyrogallic acid	7½ grains.
Glacial acetic acid	2½ drachms.
Absolute alcohol	2 do.
Distilled water	5 ozs.

This must be filtered and kept in a stopper-bottle, when it will be found to keep good for three or four weeks; but it is best when used fresh. In developing a picture much difference will be observed in hot weather and

cold, the heat accelerating the process, and the cold retarding it. Also the same difference is observable in using different developing agents; thus, pyrogallic acid is much stronger than gallic acid, and therefore will develope it much sooner. Great care should be taken to procure good pyrogallic acid. Mr. Williams thus describes it:—"Pyrogallic acid, when properly prepared, should be white and quite inodorous, crystallises in prismatic needles of silvery lustre, and perfectly soluble in alcohol and water."

Many operators hold the glasses in their hand to develope, and pour the solution on and off by means of a graduated glass; but if the plate is at all large the best method is to put it on a tripod levelling stand (See Plate VI.), and pour the solution upon it evenly and quickly, taking care to move it to and fro during the operation until the picture is properly brought out.



If the plate is sufficiently exposed it will reach its maximum in four or five minutes; if it does not do this, add to each drachm of the developing solution two drops of silver from the bath. The picture being now well brought out must be fixed in the same manner as a positive, then be washed with water, and finally, when dry, coated with chloroform varnish. Clean the other side of the plate, and it is then ready for printing from.

FAILURES ON GLASS POSITIVES.

THE collodion for positive pictures, although highly sensitive, ought not to be too much so, or the picture is apt to become dirty, &c. Streaks of almost all descriptions are caused by insoluble particles floating about in the collodion. To avoid this let the collodion settle, then pour off into another bottle. Lines crossing the plate are caused by the collodion becoming too thick. This may be remedied by adding a little ether, s. g. ·745, which will bring it to a proper consistency.

The nitrate of silver bath should always

be a little acid; that is, when the litmus paper is dipped into the solution it ought to turn red immediately. This bath must be carefully filtered from time to time.

One of the most troublesome failures that occur in the manipulation is the "fogging" of the plate, which is a misty appearance spreading all over the picture, and completely obscuring it from view. There are several causes assigned for this; one of the most important is the bath assuming an alkaline condition, which, however, can be detected by the introduction of litmus paper into the bath, when, instead of turning red, it does not change colour.

This alkalinity can be remedied by the addition of a few drops of glacial acetic acid to the bath. Another great cause of fogging is the over-saturation of the bath by iodide of silver. The bath becomes over-saturated by the newly-formed iodide of silver from

each successive plate, formed during its stay in the bath. The remedy for this is given under the head of "Failures on Negatives."

When nitric acid or protonitrate of iron is used in a developing solution, and the plate has a strong silvery appearance, it is caused by an excess of either of the former chemicals. Half tones, which are so indispensable in portraits, are lost by the bath becoming too acid. This may be cured by adding solution of ammonia drop by drop into it, trying a plate between each drop until the bath is again in order.

FAILURES ON NEGATIVES.

HAVING described in the former pages the condition of the collodion, &c., also the cause of diagonal streaks, I shall proceed with the other failures which are to be found in the practice of the negative process on glass.

Two causes have already been given for the fogging of the plates; there is another that occurs, principally in warm weather, caused by the evaporation of the bath, and, consequently, over-saturation. Under these circumstances the bath may still produce an acid reaction, and yet fog all the pictures.

This is to be avoided by adding, say, for example, to a 16-oz. bath, 3 ozs. of distilled water; it will immediately throw down a slight precipitate. It must then be filtered; after which add a sufficient quantity of pure nitrate of silver crystals as will bring it up to its proper strength.

After the bath has received many plates it will eventually cause streaks to appear on the film, caused by the quantity of ether contained in the bath. To avoid this inconvenience put the solution into a bottle, and then place it in a vessel filled with hot water up to the neck of that containing the bath for about half an hour, leaving the stopper of the bottle out. By these means you allow the ether to pass off, and the bath will work on as usual.

Many spots are caused by the accumulation of dust on the nitrate of silver bath, and as the plate is lowered into the solution the dust

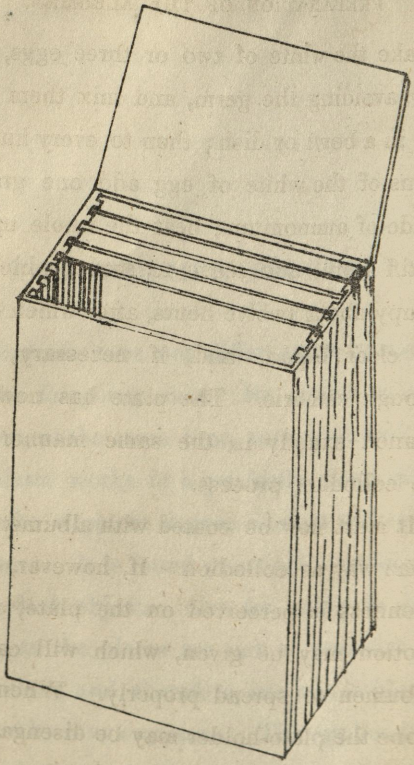
adheres to the film, and finally, in the developing, causes spots to appear, much to the annoyance of the operator. To avoid this you must keep your bath well filtered and always covered, and just before using it draw a clean piece of blotting-paper over the surface, which will attract all the dust from the bath.

When a collodion is too highly iodized it often causes the half tones to disappear by the liberation of free iodine. In this case a little plain collodion added to it will bring the desired effect.

Opaque spots are caused by over-development. Transparent spots proceed from using impure alcohol and ether in the preparation of collodion; also by omitting to pour the developing solution all over the plate. Spots will likewise appear when the glasses are imperfectly cleaned.

THE ALBUMEN PROCESS.

THIS process does not differ much in theory from the foregoing ones. Its action is very slow, but, at the same time, sure, provided the manipulator works in a perfectly clean manner, as the slightest degree of dust will spoil the picture. It is found principally useful for copying dark objects; also for using in dull weather, as the plates are not so sensitive as the collodion, and, therefore, are not liable to be spoiled by long exposure. The application of this substance to Photography on glass is due to M. Niepce de St. Victor.



PREPARATION OF THE ALBUMEN.

Take the white of two or three eggs, carefully avoiding the germ, and mix them together in a bowl or dish; then to every hundred grains of the white of egg add one grain of iodide of ammonium; beat the whole up into a stiff froth, and leave to settle, which will occupy about twelve hours, after which decant the clear liquid, and, if necessary, strain through cambric. The plate has now to be cleaned exactly in the same manner as for the collodion process.

It must now be coated with albumen in the same way as collodion. If, however, any unevenness is perceived on the plate, a rotary motion may be given, which will cause the albumen to spread properly. When this is done the plate-holder may be disengaged, and the plate placed in the drying box destined to receive it (See Plate VII.). It must remain

here for a few hours before being used for the next part of the process, which is

RENDERING THE PLATE SENSITIVE.

To do this the following bath must be prepared:—

Nitrate of silver	35 grains.
Glacial acetic acid	1½ drachm.
Distilled water	1 oz.

This is termed the aceto-nitrate bath, and the plate is to be kept in it for about two minutes, after which time it must be removed and washed in distilled water, and placed in the dark or in a box to dry; it must now be placed in the dark frame for exposure in the camera. Here, again, the author must pause, and leave the operator to judge for himself. However, as a general rule for a landscape in ordinary light, with the temperature at about 60° Fahr., from thirty to forty minutes will not be found too much. Nearer objects will take about a quarter of the time;

in bad weather it may take from six to ten hours, but a few trials will soon perfect the operator.

The plate being now sufficiently exposed, it must be removed, and placed upon a tripod levelling stand, such as is used for the collodion process, and the following solution poured upon it, viz.:—

1 oz. of a saturated solution of gallic acid.
½ drachm of aceto-nitrate of silver.

The picture will sometimes take a long time to develope, and when finally brought out (but still having a faint colour) a solution of equal parts of gallic acid and aceto-nitrate of silver may be added, which will effectually deepen the tones. When the picture is perfectly brought out it must be well washed with water, and then subjected to the

FIXING SOLUTION,

which is a saturated solution of hyposulphite of soda. On being poured on the plate the

yellow appearance of the negative gradually disappears, and when that is quite accomplished the plate must be again subjected to washing in water, and then be put aside to dry. If care be taken these plates do not require to be varnished before being printed from.

The great drawback in using this process at large is the length of time required for exposure, else the albumen itself is much more convenient than the collodion, on account of the number of plates that can be prepared at a time, also the length of time they can be kept before being used. Again, the prints taken from an albumen negative are in all respects superior to those from collodion, having more of a stereoscopic appearance; hence arises the reason why maps, and all other things with a white ground and very fine black lines upon them, are taken much easier by this process.

When photographs of maps are taken by

the collodion process the immense glare of white light casts a strong reflection upon the firm black lines, and causes them to show up in a dirty brown colour, not being able to allow sufficient time, on account of over-exposing the white ground. Prints are taken from albumen negatives in the same manner as those from collodion, and treated accordingly.

POSITIVE PROCESS ON PAPER.

THERE are several kinds of paper used for the production of positive proofs from the glass negative, the most important of which are the albumenised and the salted paper. To select these great care should be taken; and I must now advise my readers never to trust to paper that is not expressly prepared for photographic purposes. The continental manufacturers put starch in their paper, while we use gelatine; the former, however, is preferable, on account of the difficulty of obtaining good dark proofs by using thick paper. It must be smooth, and

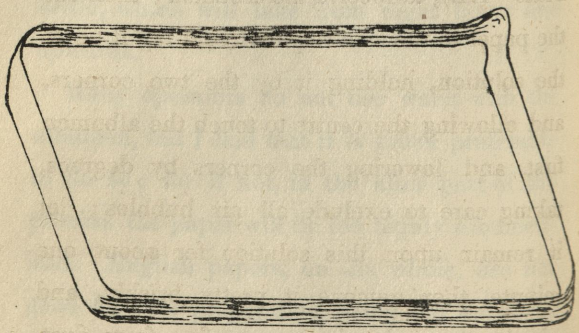
of equal thickness; it must also be free from all spots, which can only be seen by holding it up to the light. "These spots," says Mr. Hardwich, "are usually small metallic particles, which, when the paper is rendered sensitive, act as centres of chemical action, and spoil the effect." In almost all cases you will observe a difference in the smoothness of the paper when held in a certain position, so that the light strikes it at an angle. On the wrong side you will see wavy bands, caused by the stripes of felt on which it is dried. I shall now proceed with the preparation of albumenised paper, which is done in the following manner. Take

Chloride of ammonium	15 grs.
Distilled water	1 oz.

Mix any quantity of this *formula*, and add, by measure, a third of the white of new-laid eggs; then with a wooden fork beat the whole into a stiff froth. The remaining part of the

operation depends on this being done carefully, for if the albumen is not properly beaten up a portion of animal membrane will be left in the liquid, and cause streaks on the paper. It must now be placed in a long bottle to settle, which will take from eight hours and upwards.

Many operators do not use water with the albumen, but I find that it is much preferable to do so; for if not, in the after part of the process the paper will be too highly albumenised. English papers, on the whole, are not good for this preparation, being too dense to take the albumen well; those generally used are prepared by La Rive, La Croix, and Canson *frères*. There are two kinds of paper, viz., positive and negative; the former is mostly used, being prepared expressly for positives; but many operators prefer the latter on account of its thinness, and giving a greater smoothness of grain. Having used a great



deal of the positive paper I certainly consider it preferable.

The best method of applying the albumen to the paper is to procure a porcelain dish with a lip to it, about an inch deep (See Plate VIII.), to receive the albumen; then cut the paper to the size required, and lay it upon the solution, holding it by the two corners, and allowing the centre to touch the albumen first, and lowering the corners by degrees, taking care to exclude all air bubbles; let it remain upon this solution for about one minute, then remove it pretty briskly, and pin it up to dry in a room free from dust. The paper thus prepared will keep almost any length of time in a dry place.

It has now to be sensitised, which operation must be performed in a room where the daylight is obscured by the windows being blocked up with yellow calico, or, what is better, by the light of a lamp (See Plate I.).

Mix a sufficient quantity of the following solution as will cover the bottom of the dish (See Plate IX.):—

Nitrate of silver	70 grs.
Distilled water	1 oz.

Lay the paper upon it in the same manner as you did for the albumen. If the negative paper is used about three minutes will suffice for it to remain on this solution; but if the positive it will require five minutes. Now take the paper gently off with a pair of tweezers tipped with sealing-wax, and hang up by one corner in a perfectly dark place to dry, with a piece of blotting-paper at the lower corner to drain off the liquid. After a time this solution becomes slightly discoloured, but this will not hurt it; it may be restored by the application of a little animal charcoal. Paper thus prepared may be kept for some time if protected from the light.

For the preparation of plain salted paper

the following solution must be made, and the paper laid upon it in the usual way :—

Pure gelatine	1 grain.
Chloride of ammonium	8 grains.
Distilled water	1 oz.

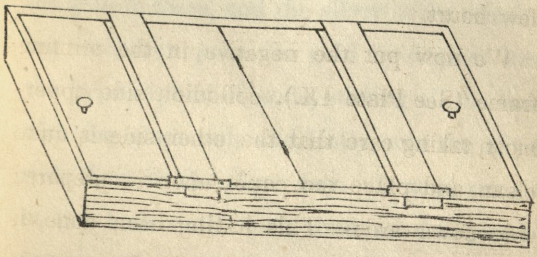
Having allowed it to remain a sufficient time on the bath, it must be dried and sensitised. There are two ways of performing this operation, either by the ordinary 70-grain solution, or by the ammonio-nitrate of silver, which must be prepared according to the following proportions :—

Nitrate of silver	80 grains.
Distilled water	1 oz.

Drop carefully into this bath a pure solution of ammonia, and stir with a glass rod. A brown precipitate at first appears, but, on the addition of more ammonia, it becomes re-dissolved. This solution must be kept in a black bottle, and never used except in a dark room. Lay the paper on as usual for four or five minutes, and hang up to dry in a dark

room. This and other solutions are sometimes put on with brushes manufactured for the purpose; but they are very troublesome, on account of the hairs which frequently come out. Paper prepared by the ammonio-nitrate of silver will not keep more than a few hours.

We now put the negative in the printing frame (See Plate IX.), collodion side uppermost, taking care that the other side is quite clean, and place the paper upon it, prepared side downwards. This having been done, it must be exposed to the light in the open air until the print is finished, which will take from twenty minutes to two days, according to the state of the weather. The printing frames are so made as to enable the operator to look at one part of the print, while the other is kept firm in its place by the pressure on the contrary side of the frame. When sufficiently exposed, it must be placed in the toning



bath, which is composed of the following ingredients:—

Chloride of gold	8 grains.
Nitrate of silver	30 grains.
Hyposulphite of soda	4 ozs.
Distilled water	8 ozs.

Dissolve the hypo in four ounces of water, the gold in three, and the silver in the remaining one, then pour the gold by degrees into the hyposulphite of soda, stirring all the time with the glass rod, and lastly, mix the silver with them in the same way. It must remain in this bath until such time as the picture requires, that is, until it has been brought to its proper colour, which is a dark chocolate; it must then be placed in a bath of the following proportions:—

Hyposulphite of soda	$2\frac{1}{2}$ ozs.
Distilled water	8 ozs.

Allow it to remain from ten minutes to a quarter of an hour, in order to complete the fixation. Some operators do not use this.

When the former toning bath is used, place it now in water, which must be changed every quarter of an hour for the first six or eight times, then left to soak in a large dish for about twenty-four hours.

The greatest care must be taken to remove all traces of the hyposulphite of soda, for if not the picture in a very short time will become dull and lose its half tones. To mount these pictures on card-board gelatine must be used, as paste made from flour may eventually become sour, and cause an acid reaction. Care must also be taken that these pictures are not hung against damp walls.

RULES TO BE OBSERVED IN MANIPULATING.

CLEANLINESS is the first and most important of them all.

Always keep a pail of water by your side for the purpose of rinsing your hands, and a clean towel to wipe them.

Wash or rinse your hands after using the hyposulphite of soda.

Clean out your graduated glasses and funnels after using them, and mind that the glass in the pressure frame is kept clean.

Keep the dark room free from dust, &c. &c.

Never leave a solution exposed in a trough after using it, but bottle it.

Never leave a bottle unstopped, especially those containing collodion.

Filter all your solutions with care; and when distilled water cannot be procured, rain water, boiled and filtered, will answer the same purpose.

Keep the nitrate of silver bath always covered up, and in a temperature not below 50° Fahr.

Be careful that the chemicals you use are pure, and do not mind a seeming expense in order to procure them good.

Keep the camera free from dust, and polish the lenses with clean wash-leather.

As amateurs, one and all of you will meet with little difficulties, which, however, will soon be overcome; therefore, never give way to them, but try again, and let your standing motto be—

"Nil desperandum,"

in conjunction with—

"Perseverantia omnia vincit."

TRAVELLING APPARATUS.

VARIOUS apparatus have been invented in the way of tents, &c., for travelling professionals and amateurs, but very little has been done towards the production of Photographic Vans. My attention has, therefore, been directed for some little time past to this subject, and I now beg to present the public with an apparatus, which, I trust, will be found useful to all parties.

For the amateur who practises this art for amusement it will be found useful to move about his own grounds; and should he be in

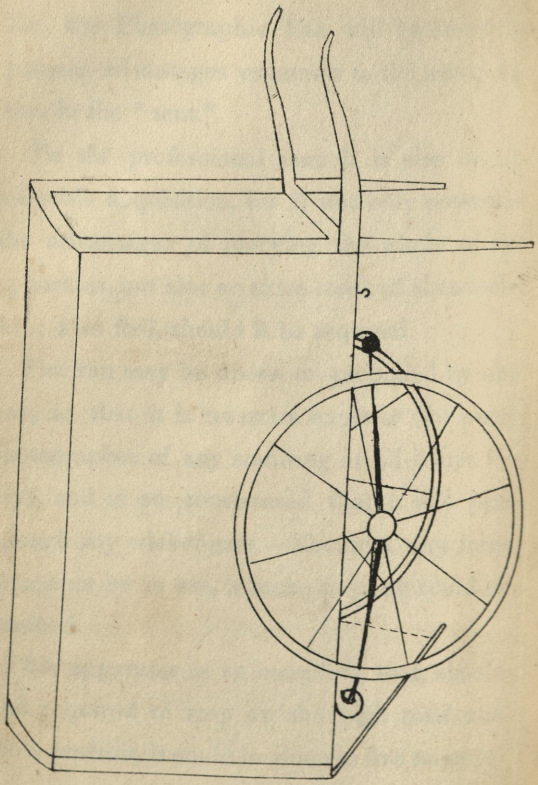
the country, where there are ruins of castles, &c., the Photographic Van will be found to possess advantages unknown to the manipulators in the "tent."

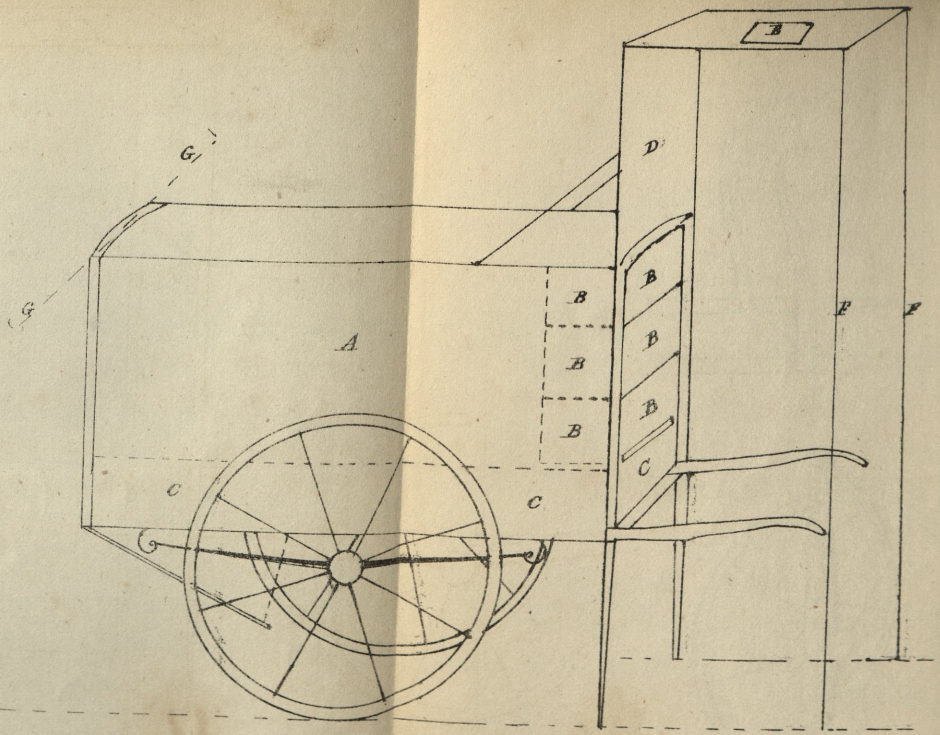
To the professional man it is also an invaluable acquisition, for it not only possesses the advantages of carrying the whole of the apparatus, but also an extra stock of chemicals, &c.; also fuel, should it be required.

The van may be drawn or propelled by any boy, so that it is no extra expense (for every photographer of any standing at all keeps his boy), and is so constructed that it will pass through any wicket-gate. Should a very large apparatus be in use, a horse or pony could be attached.

This apparatus is so complete, that, should it be required to stop on the high road and take a portrait, it could be done in five minutes' time.

I shall now proceed to describe it.





A. Body of the Van to contain Camera &c &c
B. Shelves for Chemicals in use.
C. Recess for Camera stand uprights &c.
D. Part of folding flap
E. Do. Do. with glass window
F. Uprights
G Rod for fixing background

Plate I. shows the van in its closed state, the manner in which it is drawn about the country. The proportions are as follow:—

Length of van	4 feet
„ legs	2 „
Breadth of van	18 inches
Depth of van	24 „

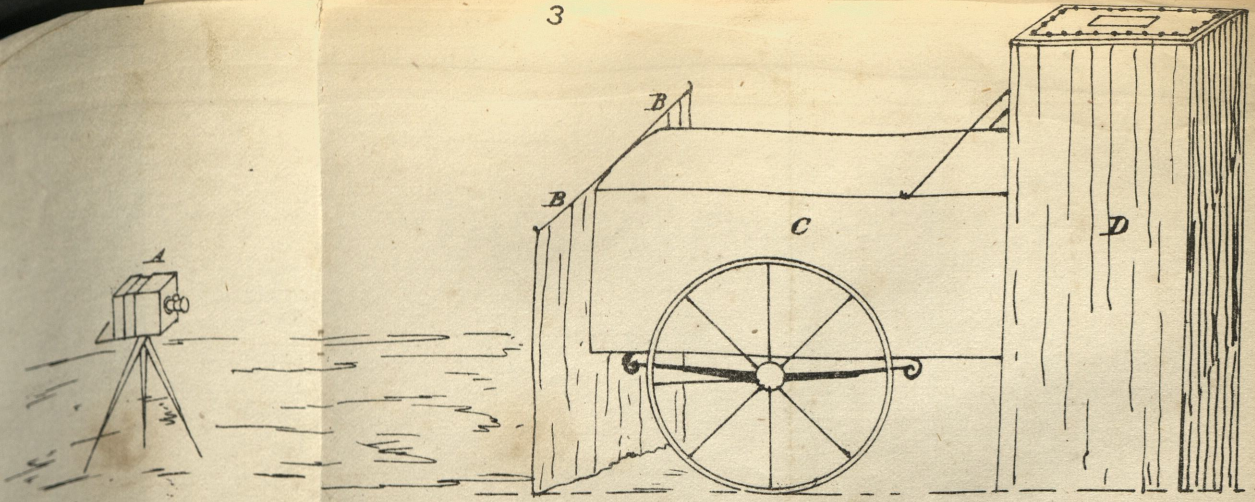
The wheels will extend four inches each side of the van, and be three feet in diameter; gradually towards the end that contains the little shelves it will spread out until it becomes twenty-six inches wide in place of eighteen, and be in a line with the edge of the wheels.

Plate II. represents the van with the folding flap up, and the uprights fixed. The flap opens with a hinge, and discloses the shelves, &c., forming at the same time a part of the dark chamber; it then opens again, and forms the roof of the dark chamber, with a yellow stained-glass window at the top; the supports are then fixed up, and the van is left as seen in this plate. The dotted lines show the

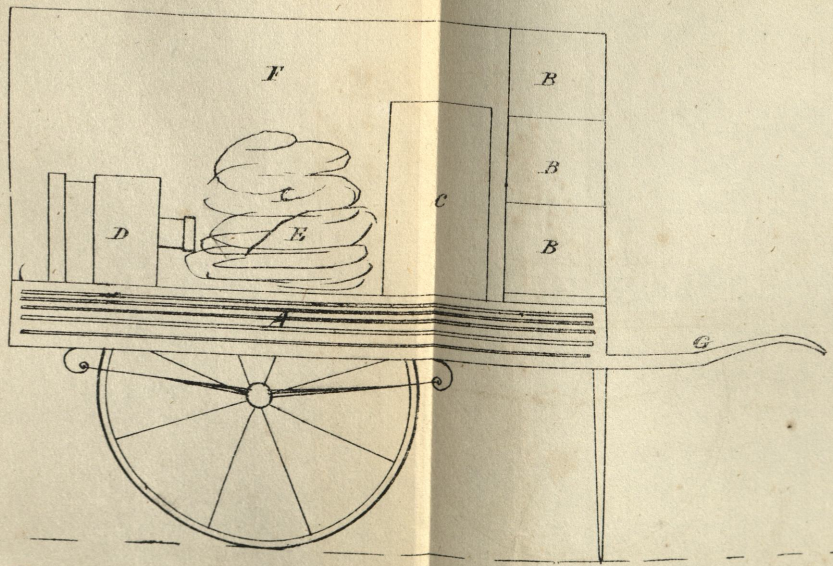
shelves and lower cupboard for the uprights and tripod stand

Plate III. shows the van and apparatus fully trimmed and in working order. The curtains have been fixed up, and the operator is in his dark room. The background will be seen at the other end of the van, and the camera at some little distance.

Plate IV. shows the interior of the van and the packing arrangement.



A. Camera and Stand
B. Back Ground
C. Van
D. Dark Chamber



A. Recess for Camera stand &c.
B. Shelves for Chemicals in use.
C. Box for extra Chemicals.
D. Camera.
E. Curtains for making dark chamber
F. Remaining space for et cetras
G. Handle of Van

APPENDIX.

It would be totally foreign to the limits of this work were the attempt made to trouble the reader with a long discourse upon the chemical combinations and decompositions which take place in every photographic process; his attention, therefore, will only be directed to those which are simple and requisite, and a few hints will be given relative to the purity of his chemicals.

All chemists define matter to be composed, or consist in its simplest form, of certain undecomposable, indestructible substances called elements, and which, by no known human agency, can be shown to consist of any other substances. Thus, for instance, brass appears to be, as it were, a

simple undecomposable substance; but, upon the intervention of chemistry, it is shown to consist of copper and zinc, two simple elements, and neither chemical action nor any other force is enabled to separate or divide them, or show them to consist of more than copper and zinc.

Chemists have fixed the number of the elements at present at sixty-two; but, doubtless, ere long chemical and philosophical research may show many of them to be combinations of each other. All of these elements possess particular attraction and affinity for each other. Thus, hydrogen and oxygen, when presented to each other, form water. Sometimes an interchange of elements takes place, as, for instance, when nitrate of silver (to use familiar language, though, strictly speaking, not chemical), which we assume to consist of nitric acid and silver, is presented to iodized collodion, consisting of either iodide of potassium, or any other iodide which consists of potassium, one element, and iodine another, the nitric acid of the silver unites with the potassium, and forms, with interchange of elements, nitrate of potash, which remains in the bath; whilst the iodine from the iodide of potassium takes the silver, and deposits the insoluble iodide of silver.

Trusting these few remarks will enable the reader

slightly to understand some of the simple chemical changes with which photographic manipulations abound, we will now proceed to examine the origin and purity of the most important of the chemicals employed.

ACETIC ACID.

This acid is, familiarly speaking, the essence or active principle of common vinegar, in which it exists, combined with water and colouring matter. There are two kinds in photographic use: the ordinary acetic acid of the shops, prepared by the distillation of wood, and which contains from 10 to 12 per cent. of real acetic acid; the other, glacial acetic acid, which is in its thorough and most concentrated form, and which, at the temperature of 45° Fahr., congeals into a crystalline mass; when diluted with water no precipitate should be produced by the addition of nitrate of silver.

ALCOHOL.

This important agent is, by many amateurs, confounded with spirit of wine of commerce; but very little reflection will enable the reader to perceive the difference, spirit of wine of commerce contain-

ing alcohol combined with water in the proportion of 10 to 13 per cent. to the remainder of spirit; and to separate it from the water is the object of the chemist, by distillation with substances having a tendency to absorb it, whilst the alcohol comes over free from that substance. Its best test is its specific gravity being ·7938; while spirit of wine of commerce has a density of ·8350.

ETHER.

This chemical agent is prepared by the action of sulphuric acid upon alcohol and distilling. The ratio and preparation would be uninteresting to the amateur, and of no avail. For some photographic purposes it should be freed from alcohol, which is present in most commercial samples, and is kept prepared for that purpose, and sold under the name of "Washed Sulphuric Ether." By being kept long it has an acid reaction with litmus paper, and should be rejected.

CHLOROFORM.

This remarkable liquid may claim a passing notice, not on account of its use in surgery and medicine,

but in photography, from its solvent powers of gum resins and volatility; hence its utility in the preparation of varnishes.

CYANIDE OF POTASSIUM.

This salt is well known to be much used as a fixing agent in photographic manipulation from its power in dissolving the iodide, chloride, and most insoluble salts of silver. It should be perfectly white, and free from any foreign matter, which gives it a greyish colour.

HYPOSULPHITE OF SODA.

This salt is of the same use in photography. It occurs in large crystals, which are perfectly soluble in water.

IODINE.

The purest specimen of iodine is that which is found in commerce under the name of "Resublimed Iodine." The most perfect test of its purity is its leaving no residue on being heated, and its perfect solubility in either alcohol or any of the soluble iodides.

IODIDE OF AMMONIUM AND POTASSIUM.

The iodide of ammonium very quickly decomposes. It should be of a white colour, and perfectly soluble in alcohol. The same applies to the iodide of potassium; but a more delicate test may be, perhaps, had recourse to, namely, the addition of a solution of sulphate of iron to a solution of iodide of potassium, when, if pure, no precipitate should be produced.

PROTO-SALTS OF IRON.

The proto-salts of iron are most used in photography, their chemical action being the avidity with which they absorb oxygen, and pass into a more oxydized state. The proto-sulphate is found in perfectly clear crystals of a bluish grey colour.

NITRATE OF SILVER.

This most important salt occurs in crystalline plates, white, and perfectly soluble in distilled water. The addition of ammonia throws down a greyish precipitate which dissolves in excess. If no colour is produced on the addition of ammonia, it is perfectly free from the presence of any other metal.

PYROGALLIC ACID.

This chemical is perfectly soluble in alcohol and distilled water. It occurs in commerce in a state of purity in small flourlet crystals, perfectly white.

SULPHURIC ACID.

The only use of this acid is in the preparation of gun-cotton, and that chemically pure should be employed. Pure sulphuric acid, when mixed with distilled water, produces no precipitate.

DISTILLED WATER.

Most, if not all, photographic preparations should be made with distilled water. When, however, this cannot be procured, rain water, boiled and filtered, will answer the same purpose.

FINIS.

Marshall & Co., Printers, 154, High Street, Southampton.